The value of computed tomography-urography in predicting the postoperative outcome of antenatally diagnosed pelviureteric junction obstruction

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Background **The natural course of pelviureteric junction (PUJ) obstruction is variable. Of those who require surgical intervention, there is no definite reliable preoperative predictor of the likely postoperative outcome. We evaluated the value of preoperative computed tomography (CT)-urography in predicting the postoperative outcome.**

Patients and methods **Ten newborns with antenatally diagnosed PUJ obstruction were evaluated after delivery with an abdominal ultrasound, and those with a renal pelvis measuring more than 3 cm in diameter were subjected to preoperative CT-urography. The kidney size, renal pelvis size, and renal parenchyma thickness were measured and documented. All underwent open surgical Anderson-Hynes dismembered pyeloplasty. The outcome was correlated to the preoperative renal parenchymal thickness as measured by means of preoperative CT-urography.**

Results **Ten newborns (seven male and three female) with PUJ obstruction were operated on. Their ages at surgery ranged from 8 days to 4 months (mean = 1.75 months). Eight had PUJ obstruction on the right side and two had PUJ obstruction on the left side. The mean renal pelvis size on the affected side was 4.9 cm (3.6–6.3 cm). The mean renal parenchymal thickness was 0.57 cm (0.25–1.3 cm). Four patients had a renal parenchymal thickness less than 0.5 cm, and these patients showed poor results on follow-up isotope scan compared with those who had a renal parenchymal thickness of more than 0.5 cm [mean = 14.9% (12–19.6%)] compared with a mean of 44.2% (33–54%).**

Conclusion **This is a preliminary report and the number of patients in our study is small to make definite conclusions, and further studies in this regard are important. We believe that renal parenchymal thickness as measured by means of preoperative CT-urography is an important predictor of the final outcome in patients with antenatally diagnosed hydronephrosis. Those who had a renal parenchymal thickness of 0.5 cm or less showed poor results on follow-up isotope scan compared with those who had a renal parenchymal thickness of more than 0.5 cm. *Ann Pediatr Surg* 12:18–21 © 2016 Annals of Pediatric Surgery.**

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Introduction

Pelviureteric junction (PUJ) obstruction is the most common cause of urinary tract obstruction in children. The majority of prenatally diagnosed PUJ obstructions resolve spontaneously, but 20–25% will worsen and require intervention [1–6]. The treatment options for PUJ obstruction include open pyeloplasty, laparoscopic and robot-assisted pyeloplasty, and endoluminal balloon dilatation [7–14]. It is, however, difficult to preoperatively predict the outcome in those treated surgically, and, until now, there is no reliable predictive variable. This is a preliminary study to evaluate preoperative computed tomography (CT)-urography in predicting the outcome in patients with antenatally diagnosed PUJ obstruction who were treated surgically.

Patients and methods

This is a prospective study to evaluate the value of preoperative CT-urography as a predictor of outcome in those with PUJ obstruction diagnosed preoperatively and required surgical intervention. All newborns with antenatally diagnosed PUJ obstruction were evaluated after delivery with an abdominal ultrasound, and those with a renal pelvis measuring more than 3 cm in diameter were subjected to preoperative CT-urography. The kidney size, renal pelvis size, and renal parenchyma thickness were measured and documented. All underwent open surgical Anderson-Hynes dismembered pyeloplasty. The kidney function was evaluated postoperatively with serial isotope scans every 6 months for the first year and then yearly after that until their function stabilizes. All patients were followed up postoperatively and the mean follow-up was 2.5 years (1.5–3.5 years). The final results and the outcome were correlated to the preoperative renal parenchymal thickness as measured by means of CT-urography.

This is a retrospective study and there was no need for approval.

Results

Ten consecutive newborns with PUJ obstruction were operated on and the renal parenchymal thickness was measured preoperatively by means of CT-urography to predict the outcome. There were seven male and three female patients. Their ages at surgery ranged from 8 days to 4 months (mean = 1.75 months). Eight had PUJ obstruction on the right side and the remaining two had PUJ obstruction on the left side. The mean renal pelvis size on the affected side was 4.9 cm (3.6–6.3 cm). The mean renal parenchymal thickness was 0.57 cm (0.25–1.3 cm). Four

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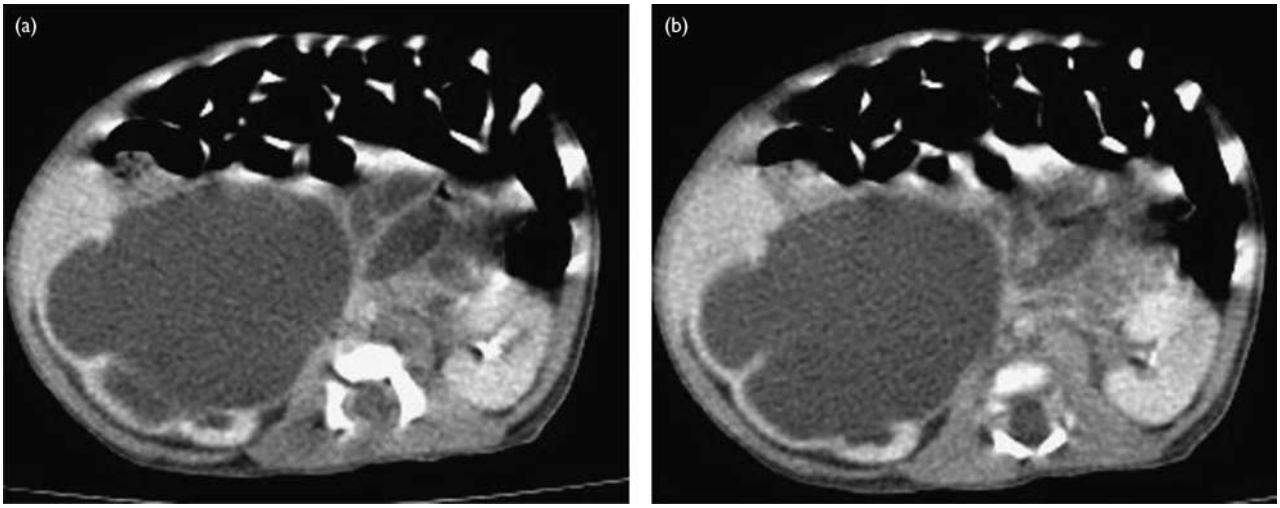
had a renal parenchymal thickness less than 0.5 cm (Fig. 1a and b). Their mean renal function on the affected side was 31.4% (12–54%). Those who had a renal parenchymal thickness of 0.5 cm or less performed poorly on follow-up isotope scan compared with those who had a renal parenchymal thickness of more than 0.5 cm (mean = 14.9%; 12–19.6%) (Fig. 2a and b), compared with a mean of 44.2% (33–54%).

Discussion

PUJ obstruction is the most common congenital abnormality of the urinary tract causing hydronephrosis and accounts for 80% of cases. The frequency of PUJ is about one to two cases per 1500–2000 live births. PUJ obstruction is more common on the left side than on the right and is more common in male than in female populations [14]. Currently, the majority of these cases are diagnosed antenatally, and this is of importance for early diagnosis and management [1,2,4]. Abdominal ultrasound and diuretic renography are used to diagnose PUJ obstruction. Recently, CT-urography and magnetic resonance urography (MRU) have been used to diagnose PUJ obstruction. A voiding cystourethrogram is used to rule out vesicoureteric reflux.

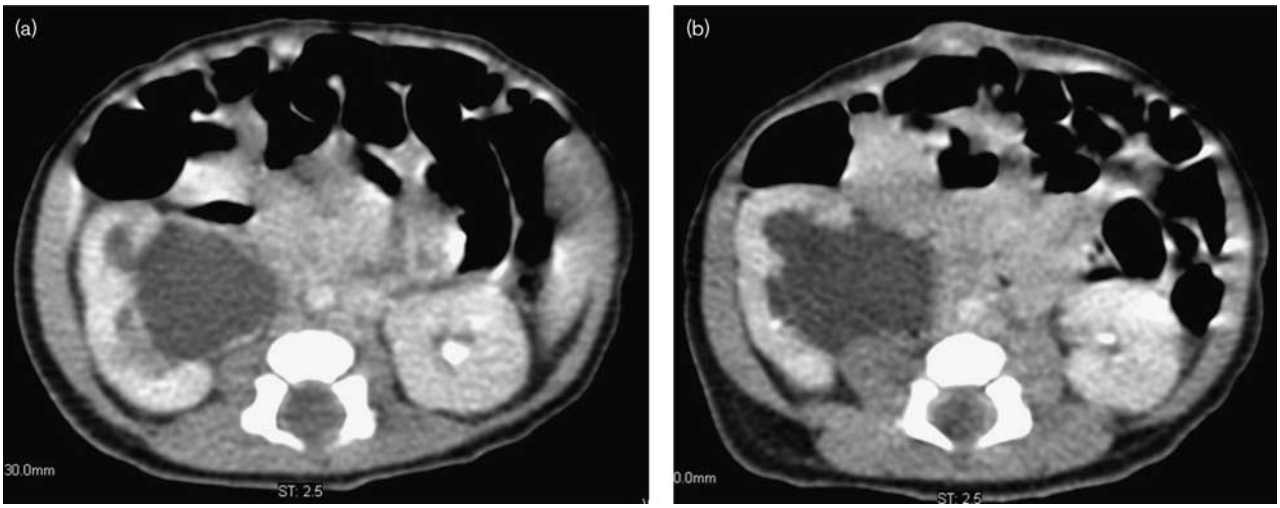
The natural course of PUJ obstruction is variable. Many patients with PUJ obstruction will have stable renal function and subsequent improvement in the degree of hydronephrosis during follow-up and observation [3,4]. The main criterion for observation in cases of PUJ obstruction with significant hydronephrosis is a split renal

Fig. 1



(a, b) Computed tomography (CT)-urography showing severe right pelviureteric junction (PUJ) obstruction. Note the thin size of the renal parenchyma. (c, d) Computed tomography (CT)-urography showing severe right pelviureteric junction (PUJ). Note the relatively thick size of the renal parenchyma.

Fig. 2



(a, b) Computed tomography (CT)-urography showing severe right pelviureteric junction (PUJ). Note the relatively thick size of the renal parenchyma.

function greater than 40% in the affected kidney by means of diuretic renography. If renography shows deterioration greater than 10% on the affected side, or a relative function of less than 40%, surgery is recommended. The other indications for surgery in PUJ obstruction include PUJ obstruction-related abdominal pain, recurrent urinary tract infection under antibiotic prophylaxis, increase in the grade of hydronephrosis on follow-up ultrasound with decrease in renal function, gross hydronephrosis with renal pelvic diameter of more than 40 mm, and bilateral severe PUJ obstruction with renal parenchymal atrophy.

The timing of surgical correction of PUJ obstruction in newborns is highly controversial. In most newborns with relatively preserved differential renal function (> 40% of differential renal function), hydronephrosis is considered a relatively benign condition and can be treated conservatively and followed up. In a study by Koff and Campbell [15], ~81 of 104 patients with PUJ obstruction were followed up for 5 years, and only seven (7%) of them ultimately required pyeloplasty, and, even in these cases, pyeloplasty successfully restored the differential renal function to predeterioration levels. This, however, is not the case always, and spontaneous resolution of hydronephrosis may not be as benign as proposed by Koff and Campbell. It has been estimated that 15–33% of patients with asymptomatic neonatal PUJ obstruction show progressive ipsilateral renal deterioration, and about one-half of them never regain the lost function with pyeloplasty [16,17]. There is still no evidence that prenatal intervention in infants with either a single obstructed kidney or bilateral involvement improves the overall renal function and outcome.

The most popular procedure to treat PUJ obstruction is the Anderson-Hynes dismembered pyeloplasty. The outcome of this procedure is, however, variable and there is no definite reliable preoperative predictor of the likely postoperative outcome. Cornford and Rickwood reviewed 321 patients with antenatally diagnosed PUJ obstruction. Of these, 47 (14.6%) had undergone pyeloplasty, 26 of them had undergone early pyeloplasty because of impaired function, and 21 underwent surgery after a period of expectant management. They concluded that, in patients born with PUJ obstruction and impaired renal function, pyeloplasty failed to significantly improve the renal function, possibly because of cortical loss. In patients with antenatally diagnosed PUJ obstruction managed expectantly there is a small but significant risk for a modest loss of renal function [18]. Duong *et al.* [19] in a review of 81 children who had PUJ obstruction found that, in children who were operated on, only impaired cortical transit was predictive of differential renal function (DRF) improvement postoperatively. Abnormal cortical transit was the only predictive factor of DRF deterioration in case of conservative approach, whereas the initial degree of hydronephrosis, or renal drainage, and the initial DRF level were not predictive of the outcome. In children who were operated on, only impaired cortical transit was predictive of DRF improvement postoperatively. Barker *et al.* [20] concluded that severe dilatation of the renal pelvis detected on second trimester ultrasound imaging predicted a significant loss of renal function. Mild and moderate degrees of dilatation were associated with a one in three risk for functional impairment in the obstructed kidney. Ben-Meir *et al.* [21] evaluated the relationship between initial effective renal plasma flow (ERPF) and final postsurgical outcome in patients with PUJ obstruction. The final ERPF was negatively related to age (younger children), and those with a higher preoperative ERPF recovered better compared with older children and those with a lower ERPF. A relative renal function greater than 51% in the obstructed kidney with 99m-technetium mercaptoacetyltriglycine was not always beneficial in predicting the prognosis, and may be a warning of impending decompensation in a minority of patients.

PUJ obstruction diagnosed antenatally is a heterogeneous condition permitting only broad predictions of functional outcome. The results from ultrasonography and diuretic renography to assess hydronephrosis can be inaccurate and sometimes misleading. We found CT-urography valuable not only in demonstrating the degree of hydronephrosis but also in accurately measuring the renal parenchymal thickness. The number of patients in our study is small to make definite conclusions, and further studies in this regard are important. We believe that renal parenchymal thickness as measured by means of preoperative CT-urography is an important predictor of the final outcome in patients with antenatally diagnosed hydronephrosis. MRU may be more useful in this regard as it avoids radiation, but MRU is not readily available [22–24].

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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